AIR CONTROL SYSTEM IN THE FRONT END OF A MOTOR VEHICLE

BACKGROUND AND SUMMARY OF THE INVENTION

[0001] This application is a national stage of International Application No. PCT/EP2003/010389, filed September 18, 2003, which claims priority under 35 U.S.C. §119 to German Patent Application No. 102 48 440.6, filed October 17, 2002, the entire disclosure of which is herein expressly incorporated by reference.

[0002] The invention relates to an air flow control system for the front end of a motor vehicle.

[0003] An air control system in the front end of a motor vehicle is disclosed in German patent document DE 38 25 071 C1. The front end of a motor vehicle has openings through which cooling air enters into a motor compartment situated behind it. The motor compartment has air ducts which carry cooling air to the units that are to be cooled, and which are formed by boundary walls running parallel to the direction of the air flow. Since the boundary walls are formed by sheet metal parts of the vehicle body, they must be sealed against one another and from the exterior in order to avoid leakage losses and back-flow, which increases the cost of assembly.

[0004] One object of the invention is to provide an air control system for the front end of a motor vehicle, in which assembly is substantially simplified.

[0005] This and other objects and advantages are achieved by the air flow control apparatus according to the invention, which is to be fitted into a vehicle having a wall that defines the front end of the vehicle, and has openings through which cooling air can flow into the motor compartment. The inflowing air is guided by air ducts adjoining the openings to the units in the motor compartment that are to be cooled. According to the invention, the air ducts are formed by defining walls that are integrated into a body panel which extends approximately crosswise to the direction of the air flow. Thus it is possible to align the boundary walls with the body panel such that both a tight connection to the openings is possible, as well as to the units arranged in the motor compartment. The body panel can be swung as a preassembled unit into the front end, together with a cooling module, without the need for additional sealing of the air ducts externally or to one another.

[0006] The body panel according to the invention can have through openings at least partially in the overlapping area of the openings. Due to the arrangement of the body panel behind the vehicle front end wall, the defining walls can extend as far as the openings in the front end wall and be in contact with the marginal area of the opening. Thus the inflowing air cannot be deflected or agitated by projecting parts.

[0007] In one embodiment, the boundary walls project approximately at right angles from the marginal areas defining the entrance openings. Sealing flanges are attached all around or shaped so that the ports can be sealed virtually

completely from adjoining body areas. Thus unwanted cross flows or turbulence can be suppressed in a simple manner.

[0008] The body panel can be disposed behind a bumper unit, and thus serve as a connecting element between the bumper and the cooling module. With such an arrangement, the body panel requires no additional fastening measures.

[0009] In a preferred embodiment of the invention, the body panel has a large-area upper through- opening situated above the flexural beam of the bumper unit. Such an upper opening can be covered with air directing elements of a grill which directs the incoming air to an intercooler arranged in the area covered by the upper opening. An additional large-area opening in the body panel can be provided below the flexural beam in order to provide cooling air to the cooling units arranged in the lower area.

[0010] The lower edge of the upper opening can be shaped so that it is in sealing contact with the back of the flexural beam. Thus eddies or cross-currents between the flexural beam and the interior part of the bumper can be suppressed.

[0011] In a preferred embodiment, circular openings are provided on both sides of the upper opening and from their round marginal areas defining the openings, a hollow cylindrical wall projects. Air intake passages for an internal combustion motor in the motor compartment can be connected to these connections. The need for a separate air guiding means can thus be eliminated.

[0012] Two additional circular openings can be formed on both sides of the upper opening, as through passages of charging air passages, which eliminates the need not only for sealing, but also for fastening means for the charging air ducts.

[0013] An outside corner area of the body panel can be fastened pivotally to the body panel, so that it can be turned inwardly to save space and turned back out again after assembly.

[0014] Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Fig. 1 is a perspective elevation of a body panel taken at an angle from in front;

[0016] Fig. 2 is a perspective elevation of the body panel of Fig. 1 taken at an angle from behind;

[0017] Fig. 3 a longitudinal section taken through a front end of a motor car along line III-III in Fig. 1;

[0018] Fig. 4 a second embodiment of a body panel in a perspective elevation seen at an angle from the front; and

[0019] Fig. 5 shows the body panel of Fig. 4 in the installed position with a cooling module.

DETAILED DESCRIPTION OF THE DRAWINGS

[0020] Figs. 1 and 2 are respective front and rear views of the body panel 1, which has an approximately T-shaped external contour and is provided with air ducts 2, 3, 4 and 5. The air duct 2 is formed by an opening 6 created in body panel 1, and has circumferential ends walls 7 which project at approximate right angles from its marginal areas. The cross section of the air duct 2 decreases rearwardly from front to back (relative to the direction of travel), while its exit opening is partially covered at both ends by planar marginal areas 8 and 9.

[0021] The air ducts 4 and 5 formed in the marginal areas 8 and 9 comprise respective passage opening 10 and 11, each of which has a hollow cylindrical defining wall 12, 13 that projects rearwardly from its perimeter. The boundary walls 12 and 13 form connections for air intake passages of an internal combustion motor situated in the motor compartment. Fastening eyes 14 provided in the marginal areas 8 and 9 serve to hold body panel 1 in its installed position. Furthermore, two corner areas 15 and 16 are provided in the upper area of the air duct 2 and are articulated on the wall 7 by a film hinge 17. During assembly, the corner areas 15 and 16 can be folded forward in the direction of the arrow K in order to reduce the width of body panel 1 during installation.

[0022] The lower air duct 3 is formed by an approximately rectangular opening 18 which has boundary walls 19 that project from its periphery.

[0023] Figure 3 is a sectional representation along line III-III in Fig. 1, which shows the arrangement of body panel 1 in the front end 20 of a motor vehicle (not further represented). The front end 20 includes a bumper unit 21 as well as a cooling module 22, and is upwardly defined by a motor hood 23 and forwardly by a front wall 24. The bumper unit 21 is formed essentially by a flexural beam 25, an inner bumper part 26 and a trim part 27. Above the bumper unit 21 an opening 28 in the front wall 24 is covered by a radiator grill 29, which comprises several air directing elements 30 running approximately parallel to one another and extending crosswise to the direction of travel F. Underneath the bumper unit 21 an additional opening 31 in the front wall 24 is covered by a plastic grill 32. A front-end apron 33 forms the bottom closure of the front wall.

[0024] The cooling module 22 comprises a radiator 34 and a condenser 35 with an accumulator 36. Above the cooling module 22 two cross plates 37 and 38 are situated closely beneath the motor hood 20. At the upper end of the cooling module 22 is the boundary wall 7 of the body panel 1 with a hooked sealing flange 39 formed on the back end. With its front end the boundary wall 7 seals the air stream from the cross plate 38.

[0025] A flange 40 of a boundary wall 19 of the body panel 1 bears against the bottom end of the cooling module 22. For connection to the front-end apron 33, the boundary wall 19 has a hooked sealing flange 41 which prevents any uncontrolled flow of the cooling air in this area.

[0026] Between the ducts 2 and 3 of the front panel 1 there is a mainly vertical connecting part 42 which is configured so as to assure a seal to the

flexural beam 25. For that purpose a flange 43 on the wall 7 that forms the upper air duct 2 lies flatly against the flexural beam 25. The boundary wall 19 which forms the air duct 3 has a sealing flange 44 which lies on a bottom plate 45 which extends inwardly from the inner part 26 of the bumper. Consequently, no appreciable turbulence or crosscurrents can occur on the flexural beam 25.

[0027] The air stream developing against the direction of travel F is divided by the openings 28 and 31 into two flows A and B above and below the bumper unit 21.

[0028] Fig. 4 shows a second embodiment of the body panel 1, in which, unlike the embodiment shown in Figs. 1 to 3, through openings 46 and 47 are provided below the connections 12 and 13 for the intake ducts of the internal combustion engine for cooling the charging air. Fig. 5 shows a corresponding pre-manufactured cooling module 22 for the embodiment of the body panel 1 of Fig. 4, which can easily be used in the front end of the automobile.

[0029] In addition to the radiator 34 and the condenser 35 with accumulator 36, a charging air cooler 48 is associated with the cooling module 22. The charging air cooler 48 extends over virtually the entire width of the air duct 2, and charging air ducts 49 and 50 issuing laterally from the charging air cooler are brought through the ducts 46 and 47.

[0030] It is especially advantageous that the body panel 1 is simply suspended by its mounting eyes 14 on projections of the cooling module 22. Thus, it requires no additional fastening of the body panel 1 after the cooling module 22

is mounted in the front end 20. The width provided by the front end 20 can be achieved by folding over the corner areas 15 and 16 of the body panel 1. After the cooling module has been inserted into the front end the corner areas 15 and 16 can be folded back again and applied sealingly with its boundary walls to the inside shape of the front end.

[0031] The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to include everything within the scope of the appended claims and equivalents thereof.

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[0001] This application is a national stage of International Application No. PCT/EP2003/010389, filed September 18, 2003, which claims priority under 35 U.S.C. §119 to German Patent Application No. 102 48 440.6, filed October 17, 2002, the entire disclosure of which is herein expressly incorporated by reference.

[0002] The invention relates to an air flow control system [[in]] for the front end of a motor vehicle~~, according to the introductory part of Claim 1~~.

[0003] An air control system in the front end of a motor vehicle is disclosed in German patent document DE 38 25 071 C1. ~~In the~~ The front end of a motor vehicle has openings ~~are created~~ through which cooling air enters into a motor compartment situated behind ~~the front end wall. In the~~ it. The motor compartment has air ducts ~~are provided~~ which carry [[the]] cooling air to the units that are to be cooled, and [[they]] which are formed by boundary walls running parallel to the direction of the air flow. Since the boundary walls are formed by sheet metal parts of the vehicle body, they ~~have to~~ must be sealed against one another and from the exterior in order to avoid leakage losses and back-flow, which increases the~~. This requires increased~~ cost of assembly.

[0004] ~~It is therefore the purpose~~ One object of the invention is to ~~create~~ provide an air control system [[in]] for the front end of a motor vehicle, in which assembly is substantially simplified.

~~This purpose is accomplished according to the invention by the characteristics of claim 1.~~

[0005] This and other objects and advantages are achieved by the air flow control apparatus according to the invention, which is to be fitted into a vehicle having [[In]] a wall that defines ~~defining~~ the front end[[,]] of the vehicle, and has openings ~~are created~~ through which cooling air can flow into the motor compartment. The inflowing air is guided by air ducts adjoining the openings to the units in the motor compartment that are to be cooled. [[The]] According to the invention, the air ducts are formed ~~according to the invention~~ by defining walls that are integrated into a body panel which extends ~~, the body panel extending~~ approximately ~~across~~ crosswise to the direction of the air flow. Thus it is possible to align the boundary walls with the body panel such that both a tight connection to the openings is possible, as well as to the units arranged in the motor compartment. The body panel can be swung as a preassembled unit into the front end, together with a cooling module, without the need for additional sealing of the air ducts externally or to one another.

[0006] The body panel according to the invention can have through openings at least partially in the overlapping area of the openings. Due to the arrangement of the body panel ~~in back of~~ behind the vehicle front end wall, the defining walls can extend as far as the openings in the front end wall and be in contact with the marginal area of the opening. Thus the inflowing air cannot be deflected or agitated by projecting parts.

[0007] In one embodiment, the boundary walls project approximately at right angles from the marginal areas defining the entrance openings. Sealing flanges are attached all around or shaped so that the ports can be sealed virtually completely from adjoining body areas. Thus unwanted cross flows or turbulence can be suppressed in a simple manner.

[0008] The body panel can be disposed ~~most thoroughly~~ behind a bumper unit, and thus serve as a connecting element between the bumper and the cooling module. ~~The body panel in~~ With such an arrangement, the body panel requires no additional fastening measures.

[0009] [[A]] In a preferred embodiment of the invention, ~~consists in the fact that~~ the body panel has a large-area upper through- opening situated above the flexural beam ~~belonging to~~ of the bumper unit. Such an upper opening can be covered with air directing elements of ~~an air-conditioning grille~~ a grill which directs the incoming air to an intercooler arranged in the area covered by the upper opening. An ~~Underneath the flexural beam an~~ additional large-area opening ~~can be provided~~ in the body panel can be provided below the flexural beam in order to provide cooling air to the cooling units arranged in the lower area.

[0010] The lower edge of the upper opening can be shaped so that it is in sealing contact with the back of the flexural beam. Thus eddies or cross-currents between the flexural beam and the interior part of the bumper can be suppressed.

[0011] In a preferred embodiment, [[two]] circular openings are provided on both sides of the upper opening and from their round marginal areas defining the openings, a hollow cylindrical wall projects. Air intake passages ~~can be connected to these connections~~ for an internal combustion motor in the motor compartment can be connected to these connections. [[A]] The need for a separate air guiding means can thus be eliminated.

[0012] Two additional circular openings can be formed on both sides of the upper opening, as through passages of charging air passages, which eliminates the need [[. Here]] not only for [[the]] sealing, but also for fastening means for the charging air ducts ~~are eliminated~~.

[0013] An outside corner area of the body panel can be fastened pivotally to the body panel, so that it ~~. This has the advantage that during assembly, this corner area~~ can be turned inwardly to save space and turned back out again after assembly.

~~Additional advantages as well as a preferred embodiment are explained hereinafter with the aid of the drawing, wherein:~~

[0014] Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Fig. 1 is a perspective elevation of a body panel taken at an angle from in front; [[,]]

[0016] Fig. 2 is a perspective elevation of the body panel of Fig. 1 taken at an angle from behind; [[,]]

[0017] Fig. 3 a longitudinal section taken through a front end of a motor car along line III-III in Fig. 1; [[,]]

[0018] Fig. 4 a second embodiment of a body panel in a perspective elevation seen at an angle from the front; [[,]] and

[0019] Fig. 5 shows the body panel of Fig. [[4in]] 4 in the installed position with a cooling module.

DETAILED DESCRIPTION OF THE DRAWINGS

[0020] [[In]] Figs. 1 and 2 are respective ~~body panel 1 is represented in a perspective~~ front and rear [[view.]] views of the body panel 1, which ~~The body panel 1~~ has an approximately T-shaped external contour and is provided with air ducts 2, 3, 4 and 5. The air duct 2 is formed by [[a]] an opening 6 created in body panel 1, and has circumferential ends walls 7 which project at approximate right angles from its marginal areas. ~~circumferential end walls 7 project at approximate right angles.~~ The cross section of the air duct 2 ~~diminishes~~ decreases rearwardly from front to back (relative to [[in]] the direction of travel), while its exit opening is partially covered at both ends by planar marginal areas 8 and 9.

[0021] The air ducts 4 and 5 ~~created~~ formed in the marginal areas 8 and 9 ~~are formed each by a~~ comprise respective passage opening 10 and 11, each of which has ~~from the marginal area of which~~ a hollow cylindrical defining wall 12, [[and]] 13 that ~~, respectively,~~ projects rearwardly from its perimeter. The boundary walls 12 and 13 form connections for air intake passages of an internal combustion motor situated in the motor compartment. ~~In the marginal areas 8 and 9 fastening~~ Fastening eyes 14 provided in the marginal areas 8 and 9 ~~are created, which~~ serve to hold body panel 1 in its installed position. Furthermore, two corner areas 15 and 16 are provided in the upper area of the air duct 2 and are articulated on the wall 7 by a film hinge 17. During assembly, the corner areas 15 and 16 can be folded forward in the direction of the arrow K in order to reduce the width of body panel 1 ~~when it is installed~~ during installation.

[0022] The lower air duct 3 is formed by an approximately rectangular opening 18 ~~from whose marginal areas~~ which has boundary walls 19 that project from its periphery.

[0023] [[In]] Figure 3 is a sectional representation along line III-III in Fig. 1, ~~Fig. 3~~ which shows the arrangement of body panel 1 in the front end 20 of a motor vehicle (not further represented). The front end 20 includes a bumper unit 21 as well as a cooling module 22, and is upwardly defined by [[an]] a motor hood 23 and forwardly by a front wall 24. The bumper unit 21 is formed essentially by a flexural beam 25, an inner bumper part 26 and a trim part 27. Above the bumper unit 21 an opening 28 ~~is made~~ in the front wall 24 [[and]] is covered by a radiator ~~grille~~ grill 29, which ~~. The radiator grille 29~~ comprises several air

directing elements 30 running approximately parallel to one another and extending crosswise to~~, which extend across~~ the direction of travel F. Underneath the bumper unit 21 an additional opening 31 ~~is made~~ in the front wall 24 [[and]] is covered by a plastic ~~grille~~ grill 32. A front-end apron 33 forms the bottom closure of the front wall.

[0024] The cooling module 22 comprises a radiator 34 and [[,]] a condenser 35 with an accumulator 36. Above the cooling module 22 two cross plates 37 and 38 are situated closely beneath the motor hood 20. At the upper end of the cooling module 22 is the boundary wall 7 of the body panel 1 with a hooked sealing flange 39 formed on the back end. With its front end the boundary wall 7 seals the air stream from the cross plate 38.

[0025] ~~The body panel 1 lies with a~~ A flange 40 of a [[its]] boundary wall 19 of the body panel 1 bears against the bottom end of the cooling module 22. ~~The boundary wall 19 has for its~~ For connection to the front-end apron 33, the boundary wall 19 has a hooked sealing flange 41 which prevents any uncontrolled flow of the cooling air in this area.

[0026] Between the ducts 2 and 3 of the front panel 1 there is a mainly vertical connecting part 42 which is configured so as to assure a seal to the flexural beam 25. For that purpose a flange 43 ~~is formed~~ on the wall 7 that forms ~~forming~~ the upper air duct 2 [[and]] lies flatly against the flexural beam 25. ~~On the~~ The boundary wall 19 ~~forming~~ which forms the air duct 3 ~~there is formed~~ has a sealing flange 44 which lies on a bottom plate 45 which extends

inwardly ~~prolonging~~ from the inner part 26 of the bumper. Consequently, no appreciable turbulence or crosscurrents can occur on the flexural beam 25.

[0027] The air stream developing against the direction of travel F is divided by the openings 28 and 31 into two flows A and B above and below the bumper unit 21.

[0028] [[In]] Fig. 4 ~~can be seen~~ shows a second embodiment of the body panel 1, in which, unlike the embodiment shown in Figs. 1 to 3, [[is]] through openings 46 and 47 are provided below the connections 12 and 13 for the intake ducts of the internal combustion engine ~~through openings 46 and 47 are provided~~ for cooling the charging air. ~~For the embodiment of the body panel 1 of Fig. 4,~~ Fig. 5 shows a corresponding pre-manufactured cooling module 22 for the embodiment of the body panel 1 of Fig. 4, which can easily be used in the front end of the automobile.

[0029] In addition to the radiator 34 and the condenser 35 with accumulator 36, a charging air cooler 48 is associated with the cooling module 22. The charging air cooler 48 extends over virtually the entire width of the air duct 2, and charging air ducts 49 and 50 issuing laterally from the charging air cooler are brought through the ducts 46 and 47.

[0030] It is especially advantageous that the body panel 1 is simply suspended by its mounting eyes 14 on projections of the cooling module 22. Thus, it requires no additional fastening of the body panel 1 ~~is required~~ after the cooling module 22 is mounted in the front end 20. The width provided by the front end

20 can be achieved by folding over the corner areas 15 and 16 of the body panel 1. After the cooling module has been inserted into the front end the corner areas 15 and 16 can be folded back again and applied sealingly with its boundary walls to the inside shape of the front end.

[0031] The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to include everything within the scope of the appended claims and equivalents thereof.